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ABSTRACT

Whether a change in dental students' attitudes toward three preselected concepts would occur as a result of a traditionally difficult dental education course as measured by the semantic differential method is determined. This study attempted to determine the predictive value of a student's attitudes in determining his/her final grade. The sample consisted of 89 first year dental students who took a 200 hour gross anatomy class. Instruments consisted of a semantic differential pretest for attitude assessment, an identical posttest, and cummulative midterm and final examinations. Three concepts chosen to assess students' attitudes were: "gross anatomy," "dental education," and "myself." The statistical treatment of the data employed factor analysis, paired t tests, and multiple regression analysis. Results indicated: (1) that students' attitudes toward the anatomy course and themselves did not change significantly, but that a significant negative change did occur in their attitude toward the dental educational experience as a whole: and (2) that students' attitudes toward specific concepts can be successfully employed to predict a portion of their final grade using the semantic differential method. (Author/RL)

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THE USE OF THE SEMANTIC DIFFERENTIAL METHOD IN ASSESSING ATTITUDES AND PREDICTING FINAL GRADES IN A GROSS ANATOMY COURSE

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Abstract

The purpose of this study was to determine if a change in dental students' attitudes toward three preselected concepts would occur as a result of a traditionally difficult dental education course as measured by the semantic differential method. In addition, it attempted to determine the predictive value of a student's attitudes in determining his/her final grade.

The sample consisted of 89 first year dental students from the Louisiana State University School of Dentistry who were enrolled in the 1979 - 1980 academic year. All students were administered the same treatment method and instruments based upon Campbell and Stanley's (1967) one group pretest posttest design. The treatment method consisted of a 200 hour gross anatomy class. The instruments consisted of a semantic differential pretest for attitude assessment, an identical posttest, and cummulative midterm and final examinations. Three concepts were chosen to assess students' attitudes. They were: "gross anatomy," "dental education," and "myself."

The statistical treatment of the data employed factor analysis, paired *t* tests, and multiple regression analysis. The factor analysis was conducted to determine which scales of the employed semantic differential loaded on the evaluative factor. The paired *t* - tests were conducted to assess pre - posttest difference between concepts. Multiple regression analysis was conducted to determine the amount of prediction that could be expected from a student's attitude toward his/her final grade.

The results indicate that students' attitudes toward a difficult gross anatomy course and themselves did not change significantly, but that a significant negative change did occur in their attitude toward the dental

educational experience as a whole. The results also indicate that students' attitudes toward specific concepts can be successfully employed to predict a portion of their final grade using the semantic differential method.

Introduction

Students' attitudes toward specific environmental characteristics within a university setting have significantly influenced their desire to persist in their studies.[1] Hayes[2] found that students' perception of themselves and their educational institutions are significantly correlated with dissatisfaction with that institution and the likelihood of dropping out. She also showed that dissatisfaction with a university was often limited to dissatisfaction with specific aspects of the university environment. Other researchers have indicated that a student's lack of interest in the course of study,[3,4] dissatisfaction with being a student,[5] and criticism of institutional rules and regulations,[6] all affect the student's attitudes toward school.

In addition, much time and effort have been spent attempting to predict the academic success rates of dental students.[7-9] These studies, however, have generally relied upon cognitive variables and have met with mixed results.[10] Chambers,[11] and more recently Boyd, Teteruch and Thompson,[12] have cited the need to include information related to such non-cognitive variables as attitudes and motivation levels of dental students.

It appears, then, that earlier studies have focused on students' perspectives toward school and the use of cognitive variables to predict student success or failure. A need exists, however, to identify a method that can be easily employed to assess attitudes toward specific course concepts while potentially providing information on the probability of student success or failure in that course.

Hence, two a priori hypotheses were examined; they were based on those factors that have been cited as having a significant influence on students' attitudes toward school[1-6] and the potential of a non-cognitive variable contributing to the prediction of success or failure among students.[11,12]

The hypotheses were:

1. that a traditionally difficult dental course (in this case, gross anatomy), would exert a change in the students' attitudes toward the concepts "gross anatomy," "myself," and "dental education" as measured by the semantic differential method; and
2. that a relationship exists between the students' attitudes toward the concepts "gross anatomy," "myself," and "dental education" and their final grade in gross anatomy.

These hypotheses, stated in the null form, provided the basis for the statistical analysis in the study.

METHOD

The 1979-1980 freshman class of the Louisisna State University School of Dentistry (LSUSD) participated in this study. During their first week of school, all students (N=101) were required to take a battery of tests, one of which was the semantic differential employed in this study. The purpose of administring the semantic differential the first week of school was to provide data to later calculate test - retest reliability. Three weeks later, at the beginning of the gross anatomy course, all students were asked to volunteer to participate in the study by signing a consent form. Of the initial 101 students enrolled, 99 students volunteered and were pretested. Of the 99 pretested, 89 completed the study (88%). Attrition was attributed to student absences during posttesting. All students were administered the same treatment and instruments based on Campbell and Stanley's one group pretest-posttest design.[13]

The treatment consisted of the gross anatomy course at LSUSD. This course consisted of 200 hours of combined lectures and laboratory experiences designed to orient the student to the structural relationship of the body with particular emphasis on the head and neck.

The instruments given to students consisted of a pretest for attitude assessment, an identical posttest, and cumulative midterm and final examinations. The pretest was given on the first day of class, the posttest was given on the last day of class, the midterm examination was given approximately half way through the 20-week course and the final examination was given two days after the last lecture.

The semantic differential method was used for the assessment of the students' attitudes. This method was chosen because previous studies have supported its reliability and validity as one measure of attitude assessment.[14] However, uncritical acceptance of the original three factors postulated by Osgood and Suci[15] has been challenged.[16,17] Recently, several researchers have successfully used only the evaluative factor in assessing attitudes using the semantic differential method.[18-20]

The specific semantic differential instrument used in this study consisted of 16 bipolar adjective pairs found to be related to the evaluative factor.[18] The choice of three concepts that the students were tested on was based upon their perceived relevance to the study. The concepts chosen were "gross anatomy", "dental education", and "myself".

The midterm and final examinations used in this study incorporated multiple choice, short answer, and oral questions. All questions were generated directly from the course objectives. The tests were developed by the Department of Anatomy and followed criteria for item and test constuction.[21] All questions were reviewed for content validity by the faculty of the Anatomy Department. Final grades were based solely upon the midterm and final examination.

RESULTS

To test the first hypothesis, a factor analysis was conducted on the pretest data to verify which of the 16 scales of the employed semantic differential loaded on the evaluative factor. Those item pairs that did not load with an absolute value of at least 0.40 on the evaluative factor were eliminated. Also, any item pair that loaded not only on the evaluative factor but also on another factor with an absolute value of 0.40 or greater was dropped. The same criteria were applied to all three concepts.

Table 1 contains the varimax rotation factor analysis loadings for the concept "gross anatomy". Eleven of the 16 bipolar adjective scales did not meet the previously mentioned criteria and were dropped. The retained scales were numbers one, two, four, 14, and 16.

Table 2 contains the varimax rotation loadings for the concept "dental education". Eleven of the 16 adjective scales did not meet the criteria and were dropped. The retained scales were numbers one, four, ten, 14, and 16.

Table 3 contains the varimax rotation factor analysis loadings for the concept "myself". Twelve of the 16 scales were eliminated because they did not meet previously mentioned criteria. The retained scales were numbers one, 14, 15, and 16.

To test the reliability of each of the reduced sets of adjective pairs for each concept, a pearson product moment correlation coefficient was calculated between the first administration and the pretest (three weeks duration). The test-retest reliability coefficient for each concept were: $r = 0.56$, $p < .001$ for "gross anatomy"; $r = 0.55$, $p < .001$ for "dental education"; and $r = 0.51$, $p < .001$ for "myself". Figure 1 contains the mean scores of the reduced set of scales for each concept for each of the three administrations of the semantic differential.

Paired t-tests between groups were then performed employing only those scales that loaded on the evaluative factor. Table 4 contains a summary of the t values and corresponding probability levels obtained by comparing pre and post-tests for each concept.

The results of the t-test analysis indicated that a significant difference existed between pre and post-tests for the concept "dental education", (t (87) = 3.32; p = .01). A significant difference was not found between pre and post-testing for the concept "gross anatomy", (t (87) = 0.95; $p \geq .05$), or between pre and post-testing for the concept "myself", (t (87) = 0.71; $p \geq .05$).

Hypothesis two was tested by stepwise multiple regression analysis to attempt to predict the student's final grade from his or her response to each pretest concept measured. The results of this analysis indicated that the employed scales of the semantic differential are fairly accurate in predicting a student's final grade. Table 5 indicates that the regression program predicted best when it selected five of the scales from all three pretest concepts (i.e., "dental education;" "gross anatomy;" "myself"), R = 0.41. By limiting the program to selecting the variables from only one concept at a time, its ability to predict was decreased: R = 0.36 for "gross anatomy" alone; R = 0.33 for "dental education" alone; and R = 0.32 for "myself" alone. The results indicated that less than 4 percent increase in variability is explained by combining all three of the concept scales.

DISCUSSION

It was reasoned that the attitude of the students toward three discrete concepts (i.e., "gross anatomy", "dental education", and "myself") would

change as a result of a difficult gross anatomy course. This reasoning was based upon the relatively large number of students who fail the course each year, the apparent corresponding attitude change that follows, and previous research that indicates that student dissatisfaction is specific to certain aspects of the university environment.[2-6]

The results of the present study indicated that, although the students' attitudes towards "gross anatomy" and "myself" did not change significantly during the course, their attitude toward "dental education" did change in a negative direction. In relation to the specific concepts, "gross anatomy" and "dental education" were included as direct measures of attitudes toward the treatment variable, while the concept "myself" was included as a control. That is, because of the threats to internal validity posed by the one group pretest-posttest design,[13] a concept that is considered to be relatively stable over time was included. Past research has indicated that self concept is a relatively stable entity within the normal population (i.e., individuals not engaged in therapy) and should not change significantly over a relatively short period of time.[22-25] This is, in fact, what was found, i.e., the concept "myself" did not change significantly from pre to posttesting. Therefore, it can be assumed that the resulting poorer attitudes toward the concept "dental education" were not attributable to the course, but rather to some other variable or combination of variables in the students' educational environment. Potential explanations for this finding include the possibility of the students' negative attitudes being an artifact of the end of a semester rush and pressures experienced just prior to exams and/or students' expectations about what they should be doing (e.g., more clinic work) not being congruent with actual curriculum requirements.

In addition to assessing changes in attitudes, an attempt was made to predict a student's final grade from a non-cognitive variable. The results of the multiple regression program ($R^2 = 0.17$) indicate that 17 percent of the total variance of a student's final grade could be predicted from only five scales of the employed semantic differential instrument. Although this degree of predictability is only moderate, it must be considered in light of the generally mixed results obtained in efforts to predict student success or failure using cognitive variables alone, and the relatively ease of this particular method of data collection. Suggestions for potentially increasing the ability to predict include increasing the number of concepts, increasing their relevance, increasing the number of non-cognitive measures employed, and/or using the attitudinal information with academic or cognitive measures.

However, in terms of predicting final grades from a non-cognitive variable such as attitudes, a note of caution should be interjected. One problem inherent in this type of study is that of inferring cause - effect relationships simply because one variable occurs before the other. It is certainly not clear that poor attitudes cause poor grades or that poor grades necessarily cause poor attitudes toward a course. The causal relationship of any set of variables can only be inferred at best, no amount of evidence can demonstrate that p does cause q[14]. Hence, the causal inference associated with these findings (and of this type of research in general), should be interpreted with care.

One insight that was achieved from these findings included the potential of this method to indicate which courses are, or are not, creating significant attitude changes in student populations. If for example, an equivalent set of semantic differential instruments were given in each

course, the obtained scores could be converted to standard scores and the resulting information employed to assess the attitude of students toward each course. The information generated could then directly aid in course reform since, as Hurlock[26] has stated, changing the cognitive perspective of an individual is not enough; the affective perspective (i.e., attitudes) must also be changed if significant long lasting changes in behavior are expected. This method could then be used to objectively assess individual courses and aid in reducing much of the subjective criticisms levied at many of them.

In summary, the results indicated that students taking a difficult gross anatomy course did not experience a significant change in attitude toward the course or toward themselves, but did experience a negative change in attitude toward dental education in general. Also, the results indicated that a non-cognitive variable can be used to predict a student's final grade, with a certain amount of success.

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TABLE 1

Varimax Loadings for the Concept "gross anatomy" on the Evaluation, Potency and Activity Factors

Scale	Evaluation	Potency	Activity
*1 Valuable - Worthless	.91	.14	.04
*2 Knowable - Unknowable	.45	.07	.12
3 Easy - Difficult	-.05	-.64	.02
*4 Good - Bad	.46	.07	.28
5 Fast - Slow	.02	.14	.03
6 Large - Small	.13	.54	.04
7 Exciting - Boring	.33	.14	.70
8 Orderly - Cluttered	.15	.02	.57
9 Active - Passive	.14	.51	.05
10 Interesting - Dull	.26	.05	.55
11 Understandable - Confusing	.08	-.16	.38
12 Simple - Difficult	-.09	-.59	.16
13 Strong - Weak	-.06	.26	.23
*14 Useful - Useless	.73	.20	.35
15 Effortless - Demanding	-.22	-.70	.02
*16 Important - Unimportant	.72	.21	.21

Variance Accounted For		
	% of Variance	Cumulative Variance
Factor 1	71.8	71.8
Factor 2	17.2	89.0
Factor 3	11.0	100.0

*Scales meeting, Criteria

TABLE 2

Varimax Loadings for the Concept "dental education" on the Evaluation, Potency and Activity Factors

Scale		Evaluation	Potency	Activity
*1	Valuable - Worthless	.55	.03	.27
2	Knowable - Unknowable	.37	-.01	.00
3	Easy - Difficult	-.22	.65	.25
*4	Good - Bad	.63	-.18	.14
5	Fast - Slow	.09	-.07	.49
6	Large - Small	.02	-.25	.59
7	Exciting - Boring	.41	.06	.41
8	Orderly - Cluttered	.34	-.09	.06
9	Active - Passive	.24	-.51	.31
*10	Interesting - Dull	.59	-.04	.33
11	Understandable - Confusing	.16	.15	-.07
12	Simple - Difficult	.21	.73	-.41
13	Strong - Weak	.20	-.27	.42
*14	Useful - Useless	.72	.05	.11
15	Effortless - Demanding	-.12	.69	-.29
*16	Important - Unimportant	.65	-.18	-.05

	Variance Accounted For	
	% of Variance	Cumulative Variance
Factor 1	72.9	72.9
Factor 2	16.4	89.3
Factor 3	10.7	100.0

*Scales meeting, Criteria

TABLE 3

Varimax Loadings for the Concept "myself" on the Evaluation, Potency and Activity Factors:

Scale	Evaluative	Potency	Activity
*1 Valuable - Worthless	.74	.14	.04
2 Knowable - Unknowable	.35	.23	.24
3 Easy - Difficult	.13	.02	.65
4 Good - Bad	.42	.40	.14
5 Fast - Slow	.27	.47	-.15
6 Large - Small	.09	.54	.02
7 Exciting - Boring	.52	.47	.14
8 Orderly - Cluttered	.07	.41	-.04
9 Active - Passive	.49	.52	.10
10 Interesting - Dull	.59	.51	.08
11 Understandable - Confusing	.13	.62	.03
12 Simple - Difficult	-.02	.05	.79
13 Strong - Weak	.41	.56	.03
*14 Useful - Useless	.80	.27	.03
*15 Effortless - Demanding	-.40	-.21	.19
*16 Important - Unimportant	.71	.06	.10

	Variance Accounted For	
	% of Variance	Cumulative Variance
Factor 1	70.6	70.6
Factor 2	17.3	87.9
Factor 3	12.1	100.0

*Scales meeting, Criteria

TABLE 4

T-test Comparisons Between Pre and Posttests for the Concepts "dental education", "gross anatomy", and "myself".

Concept	N	Mean	t	df	p
"dental education"					
Pre	88	33.51	3.32	87	.01
Post	88	32.77			
"gross anatomy"					
Pre	88	30.06	.95	87	.35
Post	88	29.58			
"myself"					
Pre	88	21.67	.71	87	.69
Post	88	21.51			

TABLE 5

Scales Selected From Each Concept For Predicting The Final Grade By A Stepwise Multiple Regression Program

Concept	SCALE	MULTIPLE R	R^2	F	P
Gross Anatomy	Large - Small	.20	.04	5.2	.03
Gross Anatomy	Knowable - Unknowable	.27	.07	4.7	.03
Dental Education	Exciting - Boring	.34	.12	5.6	.02
Dental Education	Useful - Useless	.39	.15	4.0	.05
Myself	Knowable - Unknowable	.41	.17	1.8	.19

	MULTIPLE R	R^2	df	F	P
All five scales combined	.41	.17	5.84	3.38	.01

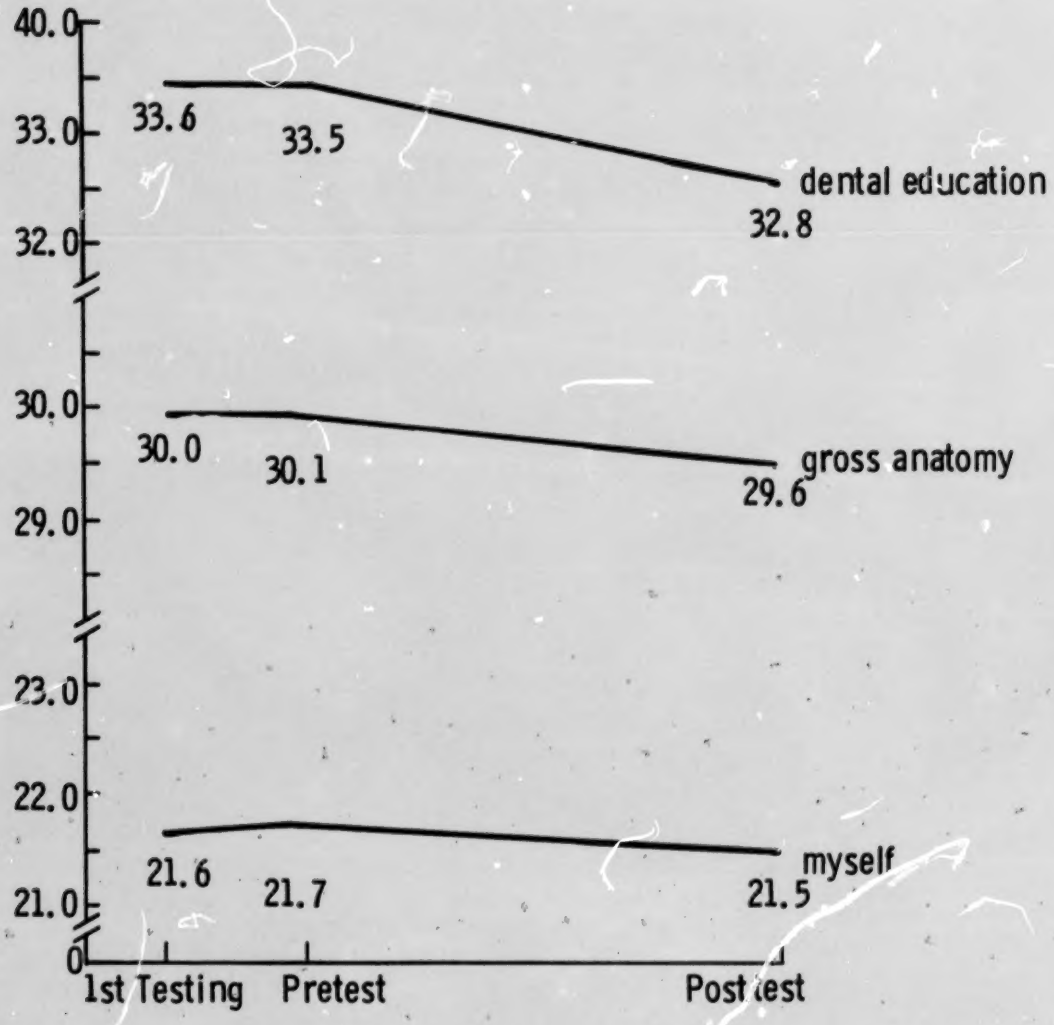

Figure 1. Mean First Testing, Pretest, and Posttest Scores For The Concepts "dental education", "gross anatomy", and "myself".